Customer No.: 31561
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Application No.: 10/711,473

In The Claims:

Claim 1. (currently amended) The low temperature polysilicon thin film transistor, comprising:

a substrate;

a polysilicon layer, disposed over the substrate, and the polysilicon layer comprising a lightly doped drain, a channel region inside the lightly doped drain region and a source/drain region outside the lightly doped drain region;

a gate insulation layer, disposed over the substrate covering the polysilicon layer;

a gate buffer layer, arranged over the gate insulation layer covering the channel region and the lightly doped drain;

a gate, disposed over the gate buffer layer covering the channel region, wherein the gate buffer layer is disposed between the gate and the gate insulation layer;

a dielectric layer, arranged over the gate insulation layer covering the gate;

a drain metal layer, disposed over the dielectric layer and through the dielectric layer and the gate insulation layer to electrically connect with the drain region; and

a source metal layer, disposed over the dielectric layer and through the dielectric layer and the gate insulation layer to electrically connect with the source region.

Claim 2. (original) The low temperature polysilicon thin film transistor of claim 1, wherein a material constituting the gate comprises a metal.

Claim 3. (original) The low temperature polysilicon thin film transistor of claim 2, wherein a material constituting the gate buffer layer comprises a metallic compound.

Claim 4. (original) The low temperature polysilicon thin film transistor of claim 3, wherein the metallic compound is selected from a group consisting of a metal oxide, a metal nitride and a metal carbide.

Claim 5. (original) The low temperature polysilicon thin film transistor of claim 3, wherein the portion of the gate buffer layer nearer to the gate insulation layer has lower amount of metal.

Claim 6. (original) The low temperature polysilicon thin fin transistor of claim 1, wherein a material constituting the gate buffer layer comprises a dopant containing material.

Claim 7. (original) The low temperature polysilicon thin fin transistor of claim 6, wherein the portion of the gate buffer layer nearer to the gate insulation layer has more amount of dopant.

Claim 8. (original) The low temperature polysilicon thin fin transistor of claim 1, wherein a portion of the lightly doped drain nearer to the source/drain region has a higher dopant concentration.

Claim 9. (original) The low temperature polysilicon thin film transistor of claim 1, wherein a structure of the gate buffer layer is ladder-shape.

Claim 10. (original) The low temperature polysilicon thin film transistor of claim 1, wherein a structure of the gate buffer layer is taper-shape.

Claim 11. (original) The low temperature polysilicon thin film transistor of claim 1, further comprising a buffer layer arranged between the substrate and the polysilicon layer.

Claim 12. (currently amended) The method of fabricating a lightly doped drain region, comprising:

forming a polysilicon layer over a substrate;

forming a gate insulation layer over the polysilicon layer;

sequentially forming a gate buffer layer over the gate insulation layer and a gate over the gate buffer layer so that the gate buffer layer is formed between the gate and the gate insulation layer, wherein an edge portion of the gate buffer layer is exposed; and

performing a doping process to form a lightly doped drain region in the polysilicon layer underneath the exposed portion of the gate buffer layer.

Claim 13. (original) The method of fabricating a lightly doped drain region of claim 12, wherein the steps of forming the gate buffer layer and the gate comprises:

forming a gate buffer material layer over the gate insulation layer and forming a gate material layer over the gate buffer layer; and

patterning the gate material layer and the gate buffer material layer to form the gate and the gate buffer layer using a photolithography process and an etching process, wherein an etching rate of the gate material is larger than that of the gate buffer material.

Claim 14. (original) The method of fabricating a lightly doped drain region of claim 13, wherein the gate material is formed by a sputtering process and the gate buffer material layer is formed by a sputtering process containing a reactive gas.

Claim 15. (original) The method of fabricating a lightly doped drain region of claim 14, wherein the reactive gas is selected from a group consisting of an oxygen containing gas, a nitrogen containing gas and a carbon containing gas.

Claim 16. (original) The method of fabricating a lightly doped drain region of claim 14, wherein the reactive gas comprises a dopant containing gas.

Claim 17. (original) The method of fabricating a lightly doped drain region of claim 14, wherein an amount of the reactive gas is decreased with time during the sputtering process.

Claim 18. (original) The method of fabricating a lightly doped drain region of claim 12, further comprises a step of forming a buffer layer over the substrate before the step of forming the polysilicon layer over the substrate.